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U. S. DEPARTMENT OF AGRICULTURE.

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U.S. Department of Agriculture.

REPORT

OF THE

ACTING CHIEF OF THE DIVISION OF BIOLOGICAL SURVEY

FOR

1898.

BY

T. S. PALMER.

[From the Report of the Secretary of Agriculture.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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REPORT OF THE ACTING CHIEF OF THE DIVISION OF BIOLOGICAL SURVEY.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF BIOLOGICAL SURVEY,
Washington, D. C., September 1, 1898.

SIR: I have the honor to submit herewith a report of the work of the Biological Survey for the fiscal year ending June 30, 1898.

Respectfully,

T. S. PALMER,
Acting Chief, Biological Survey.

Hon. JAMES WILSON, *Secretary.*

WORK OF THE YEAR.

LIFE ZONES OF THE UNITED STATES.

The Biological Survey has undertaken to map the natural life zones of the United States and to furnish information which will aid the farmer and horticulturist in the selection of crops best adapted to their localities. The boundaries of these life zones are determined by a detailed study of the distribution of animals and plants, for it is believed that areas inhabited by native species coincide with those adapted for certain fruits, cereals, and breeds of domesticated animals.

The fiscal year ending June 30, 1898, marks an important advance in the work of this office by the completion of the first detailed report showing the particular varieties of crops adapted to the several zones. Investigations on geographic distribution have been carried on since the organization of the division, but progress has been necessarily slow. The first step (begun with the establishment of the Division of Ornithology and Mammalogy) consisted in systematically collecting and tabulating all the available information respecting the distribution of mammals and birds. The data thus obtained were platted on maps and subsequently amplified by observations made in the field.

In 1889 a careful survey was undertaken of an area comprising 5,000 square miles in the San Francisco Mountain region of northern Arizona, a region which offered exceptional advantages for studying geographic distribution of species. Among the most important results of this experimental survey may be mentioned the recognition of seven life zones on the continent of North America, and the publication of a provisional biogeographic map showing their approximate boundaries. The publication of the report on the San Francisco Mountain region may fairly be said to mark the beginning of the second stage of the work.

In the following year Congress removed the restriction confining the investigations to the geographic distribution of mammals and birds, thus enlarging the scope of the work and in effect establishing a

Biological Survey, although the change in name (from Division of Ornithology and Mammalogy) was not made until July 1, 1896. In the meantime systematic surveys had been made of southern Idaho (1890), southern California and Nevada (1891), and portions of Oregon and Washington. The information thus brought together, in addition to data already accumulated by the tabulation of records on the distribution of species, resulted in the publication of two new editions of the biogeographic map, one in 1892 and the other in 1893. The third map, which appeared in the Annual Report of the Secretary of Agriculture for 1893, was accompanied by a brief statement concerning the principal crops adapted to each of the life zones.

The principal life areas having been mapped, and the more important species of mammals, birds, and trees characteristic of each area determined, it remained to ascertain the boundaries with sufficient detail to permit the publication of larger scale maps and to investigate the varieties of the several crops best adapted to each area.

CEREAL INVESTIGATIONS.

Early in 1897 the third stage of the work was begun by an investigation of the geographic distribution of cereals, which was intrusted to Prof. C. S. Plumb, director of the Agricultural Experiment Station of Indiana. As already stated in the Annual Report for last year, Professor Plumb collected information from more than a thousand grain growers regarding the varieties of corn, wheat, and oats cultivated most successfully in the United States and Canada. The data for each variety were tabulated separately and maps prepared showing the points from which reports had been received. It was found that the profitable cultivation of most varieties of cereals was restricted to two, and in some cases to a single one, of the life zones. This report was received last year, but its publication was delayed, pending the preparation of maps necessary to illustrate the text. The report is now in the hands of the Public Printer, and will be issued as Bulletin No. 11.

The revised edition of the map of life zones of the United States mentioned in the last Annual Report has been prepared from new data furnished by recent field work and is corrected up to the close of 1897. The publication of this map and the report on cereals furnished an opportunity for explaining more fully than had yet been done the bearing of the work of the division on practical agriculture. A special bulletin, No. 10, entitled "Life zones and crop zones of the United States," was accordingly prepared, in which the subject was treated under the following heads: (*a*) "Relation of the Biological Survey to agriculture;" (*b*) "Life zones of the United States;" (*c*) "Laws of temperature control of the geographic distribution of animals and plants;" and, (*d*) "Crop tables," including lists of the principal varieties of grain and fruit adapted to each zone.

PUBLICATIONS.

The publications issued during the year include the map of the life zones of the United States already mentioned, two articles in the Yearbook of the Department for 1897, one number of North American Fauna (No. 13), and a revised edition of Bulletin No. 8 on "Jack rabbits of the United States." Reprints were also issued of Farmers' Bulletin 54 on "Common birds in relation to agriculture," Bulletin 8 on "Jack rabbits," and Circular No. 20 on "Bird day in the schools."

One of the articles in the Yearbook was devoted to the work of the survey, detailing its methods, objects, main results accomplished, and the practical value of its investigations to the farmer. The other paper, entitled "Birds that injure grain," consisted of a brief account of the injuries to cereal crops caused by blackbirds, grackles, crows, cowbirds, and quails. Fauna No. 13, a technical report issued in a small edition, contained a critical revision of the bats of the family *Vespertilionidæ*, a group which includes most of the species in North America. The bulletin on jack rabbits was originally published in 1896 and had been out of print for some months. In the interval since its publication much new information had been accumulated, which was incorporated in the revised edition issued in December, 1897, and again reprinted in March, 1898.

The following bulletins were prepared and submitted for publication during the fiscal year: No. 9, "Cuckoos and shrikes in their relation to agriculture;" No. 10, "Life zones and crop zones of the United States," and No. 11, "The geographic distribution of cereals in North America." These bulletins are so near completion that their early appearance may be looked for.

GEOGRAPHIC DISTRIBUTION.

During the fiscal year ending June 30, 1898, field work was carried on in the four Pacific States of Washington, Oregon, California, Nevada, and in northern Mexico and southern British Columbia. The determination of the boundaries of the life zones in the northwest, begun in 1896, was continued throughout last season, and four field parties were engaged in Washington and Oregon. Mount Rainier, parts of the Cascade Range, the Olympic Mountains, the coast region north of Grays Harbor, the north central part of the State along the international boundary, and the Blue and Wallowa mountains in northeastern Oregon were all worked with more or less detail. In the spring of 1898 a reconnaissance was made in central and eastern Nevada. This was extended westward across northeastern California to Mount Shasta and the adjacent region. Progress has been made in working up the material collected in Oregon and Washington during the last two seasons, and the report will be prepared for press as soon as practicable.

ECONOMIC RELATIONS OF MAMMALS AND BIRDS.

Investigations of the economic relations of particular mammals and birds were continued throughout the year, and about 2,300 stomachs of birds were examined in the laboratory. These stomachs may be arranged in the following groups:

Sparrows	1,353
Swallows	265
Woodpeckers	259
Flycatchers	164
Cuckoos	136
Blackbirds	84
Miscellaneous	68
Total	2,329

Special attention was paid to several beneficial birds, particularly those which feed on hairy caterpillars and weed seed. Comparatively few species beside our native cuckoos eat hairy caterpillars, but a

cuckoo has been known to destroy an entire colony of these insects at a single meal, and the abundance of cuckoos in certain localities is reported to be dependent to a certain extent upon the presence of hairy caterpillars. A careful study of the food habits of cuckoos was undertaken, including an examination of all the available stomachs (155), and the results prepared for publication. The investigation on the food of the shrikes was completed and the report carefully revised. These two reports will appear together as Bulletin No. 9 of the division series.

Several native sparrows are efficient agents in the destruction of weeds, since they devour immense quantities of weed seed during winter and early spring when other food is scarce. This subject merits careful study, as the value of these birds has not been generally recognized. Twenty-five hundred stomachs of native sparrows representing about thirty species and subspecies have already been examined in the laboratory, and these examinations have been supplemented to some extent by field observations. While the work is well under way, much remains to be done before it can be completed and the report prepared for publication.

Many of the questions which arise in studying the food habits of birds can not be settled by an examination of stomachs in the laboratory. It is necessary to know something more than the fact that a bird was killed at a certain season in a field of grain, because the abundance or scarcity of insects and seeds in the neighborhood may determine largely whether the bird was attracted to cultivated fields merely because of failure of its regular supply of food. Field work has therefore received more attention than usual this year, and an experimental study of the habits of certain birds in a limited area has been begun. A tract of land specially adapted for the purpose on account of diversity in crops was selected for observation near the city of Washington. The fields have been visited at different seasons, the birds carefully observed, and material collected from time to time to show the benefit or injury done to the crops.

The Iowa Ornithological Association has undertaken a comprehensive study of the birds of its State and has requested assistance in working up the material collected to illustrate the food habits of the various species. All the bird stomachs obtained by members of the association are forwarded to the Department, and much desirable material has been secured in this way, the number of stomachs received during the spring of 1898 aggregating 240.

IDENTIFICATION OF SPECIMENS.

As in former years, large numbers of specimens have been received for identification. While this part of the work consumes a good deal of time, correspondents are always encouraged to send in specimens about which they are in doubt, since these specimens often increase the value of accompanying notes and reports. The work also has an educational value, since it tends to a more general diffusion of knowledge of our native species and stimulates the study of their habits and life histories.

ROUTINE WORK.

Much of the time of the office force is necessarily devoted to routine work. About 2,700 letters were received during the year, many of them accompanied by reports, schedules, and notes, which were

examined and filed for future reference. Some of this correspondence relates to reports of the division and can be answered by circulars, but the larger part consists of inquiries concerning mammals and birds, requiring special replies, which often necessitate the expenditure of considerable time in preparation. About 2,000 letters were written and several hundred schedules distributed to correspondents; about 300 packages were received and 650 sent out. Other regular work consists in the arrangement of reports and information received from field naturalists and correspondents, care of collections, unpacking and repacking specimens received for identification, furnishing supplies to field naturalists, preparation of reports and bulletins for publication, and of reference lists useful in the work of the division.

PLANS FOR THE FISCAL YEAR ENDING JUNE 30, 1899.

Since the work already outlined for the Biological Survey will require much time for completion, the plans for a single year relate to details rather than to change in character or methods of investigation. The work for 1898–99, therefore, will consist mainly in a continuance of investigations now under way, which will be pushed to completion as rapidly as practicable.

The principal field work during the summer of 1898 will be done in northern California, in the region from Mount Shasta and Lassen Peak to the coast. This area is immediately south of the region covered in 1896 and 1897, and the work this season is expected to include the southern extension of the northwest coast fauna in California, thus continuing the work previously done in Oregon and Washington and furnishing data necessary for the completion of the report. The work of the present season also includes the running of a number of zone lines in other parts of California.

Investigations on the native sparrows, flycatchers, swallows, and other useful birds will be continued in the laboratory. The plans for the year contemplate supplementary field investigations in Maryland and one or two of the New England States, including studies of the food habits of birds in regions infested with such insect pests as the gipsy moth, army worm, and cutworm.

PLANS AND ESTIMATES FOR FUTURE WORK.

As the work of the Biological Survey becomes more generally known and better understood the demands for information, maps, and reports increase far more rapidly than the means for meeting them. Requests are frequently received for biological maps of certain States or areas, for zone maps on a larger scale than those yet published, and for maps of the distribution of particular species of mammals or birds. Maps of the life zones of the United States are sought, not only by agriculturists, but by teachers and others who wish them for purposes of instruction or reference. Several of the States have in contemplation or have already inaugurated local biological surveys, and have appealed to the Department for assistance or cooperation in this work. These surveys are greatly needed in several sections of the United States, and in some cases it would be desirable for the Department to assist in carrying them on. Demands like these from the general public, from experiment stations, and from State authorities are worthy of careful consideration, and some provision should

be made for meeting them in the near future. The present appropriations are insufficient for the purpose, for, as already shown, the investigations have increased considerably in the last decade, while the appropriations have remained unchanged for several years. The division has no funds available for printing expensive large-scale maps; it has been obliged thus far to decline every request for cooperation in State surveys, and has necessarily confined itself closely to the work already outlined.

One of the most important investigations demanding attention is a thorough study of the fauna and flora of the tropical region which lies along our southern border and enters the United States at several points. Such an investigation should cover a sufficiently wide area to ascertain the characteristic features of the region, including its topography, fauna, and flora, and particularly the crops which are or may be most profitably cultivated. The subject is of special importance at this time from the fact that the territory recently annexed by the United States lies entirely within the tropics. Moreover, the question of what semitropical or tropical products can now be profitably grown in Florida and the Gulf States, in competition with those from our island possessions, is likely to be a very important and practical one in several of the Southern States. In view of these facts, therefore, I desire to renew the recommendation that an increase of $5,000 be made in the lump fund for biological investigations. This increase would enable the division to publish more maps, to cooperate in State surveys, and to undertake a thorough investigation of the fauna and flora of the tropical region; in short, to carry out more fully the work assigned to it by Congress.